Contents

Preface from the Conference Co-Chairman vii
Preface from the Program Co-Chairman viii

KEYNOTE ADDRESS

Photovoltaics and materials science: helping to meet the environmental imperatives of clean air and climate change
W.R. Moomaw 1

NEW DIRECTIONS IN CRYSTAL GROWTH

Microgravity protein crystal growth; results and hardware development
L.J. DeLucas, C.D. Smith, D.C. Carter, R.S. Snyder, A. McPherson, S. Koszelak and Ch.E. Bugg 12
SiC boule growth by sublimation vapor transport
D.L. Barrett, R.G. Seidensticker, W. Gaida, R.H. Hopkins and W.J. Choyke 17
Characterization of MOCVD fluid dynamics by laser velocimetry
E.J. Johnson, P.V. Hyer, P.W. Culotta, L.R. Black, I.O. Clark and M.L. Timmons 24
The feasibility of using trimethylamine alane as an Al precursor for MOMBE
C.R. Abernathy, A.S. Jordan, S.J. Pearton, F. Ren, F. Baiocchi, D.A. Bohling and G.T. Muhr 31
Applications of single crystals in oil well logging
C.L. Melcher, J.R. Schweitzer, R.A. Manente and C.A. Peterson 37

CRYSTAL GROWTH THEORY AND MODELING

Simulation of surface morphologies in crystal growth from the vapor
R.F. Xiao, J.I.D. Alexander and F. Rosenberger 43
Modelling of directional solidification: from Scheil to detailed numerical simulation
R.A. Brown and D.H. Kim 50
Transient simulations of convection and solute segregation of GaAs growth in gradient freeze furnace
D.H. Kim and R.A. Brown 66
Computed stress fields in GaAs during vertical Bridgman growth
W. Rosch and F. Carlson 75
Magnetic and thermal field model of EFG system
S. Rajendran, C.C. Chao, D.P. Hill, J.P. Kalejs and V. Overbye 82
Epitaxially grown semiconductor surfaces
S. Krishnamurthy, M.A. Berding, A. Sher and A.-B. Chen 88
Numerical study on Czochralski growth of oxide single crystals
Y. Okano, T. Fukuda, A. Hirata, N. Takano, T. Tsukada, M. Hozawa and N. Imaishi 94
Moments of momenta as predictors of "molecular" species in crystal growth solutions
P.G. Barber 99

MELT GROWTH AND SOLIDIFICATION

Effect of nonequilibrium interface kinetics on cellular breakdown of planar interfaces during rapid solidification of Si–Sn
D.E. Hoglund, M.J. Aziz, S.R. Stiffler, M.O. Thompson, J.Y. Tsao and P.S. Peercy 107
Evolution of solidification microstructures at high interface growth rates
J.A. Sekhar 113
Some consequences of a strong interface field-effect operating during the growth of TiO_2–alloy crystals from the melt
W.A. Tiller and C.T. Yen 120

Contents

Preface from the Conference Co-Chairman vii
Preface from the Program Co-Chairman viii

KEYNOTE ADDRESS

Photovoltaics and materials science: helping to meet the environmental imperatives of clean air and climate change
W.R. Moomaw 1

NEW DIRECTIONS IN CRYSTAL GROWTH

Microgravity protein crystal growth; results and hardware development
L.J. DeLucas, C.D. Smith, D.C. Carter, R.S. Snyder, A. McPherson, S. Koszelak and Ch.E. Bugg 12
SiC boule growth by sublimation vapor transport
D.L. Barrett, R.G. Seidensticker, W. Gaida, R.H. Hopkins and W.J. Choyke 17
Characterization of MOCVD fluid dynamics by laser velocimetry
E.J. Johnson, P.V. Hyer, P.W. Culotta, L.R. Black, I.O. Clark and M.L. Timmons 24
The feasibility of using trimethylamine alane as an Al precursor for MOMBE
C.R. Abernathy, A.S. Jordan, S.J. Pearton, F. Ren, F. Baiocchi, D.A. Bohling and G.T. Muhr 31
Applications of single crystals in oil well logging
C.L. Melcher, J.R. Schweitzer, R.A. Manente and C.A. Peterson 37

CRYSTAL GROWTH THEORY AND MODELING

Simulation of surface morphologies in crystal growth from the vapor
R.F. Xiao, J.I.D. Alexander and F. Rosenberger 43
Modelling of directional solidification: from Scheil to detailed numerical simulation
R.A. Brown and D.H. Kim 50
Transient simulations of convection and solute segregation of GaAs growth in gradient freeze furnace
D.H. Kim and R.A. Brown 66
Computed stress fields in GaAs during vertical Bridgman growth
W. Rosch and F. Carlson 75
Magnetic and thermal field model of EFG system
S. Rajendran, C.C. Chao, D.P. Hill, J.P. Kalejs and V. Overbye 82
Epitaxially grown semiconductor surfaces
S. Krishnamurthy, M.A. Berding, A. Sher and A.-B. Chen 88
Numerical study on Czochralski growth of oxide single crystals
Y. Okano, T. Fukuda, A. Hirata, N. Takano, T. Tsukada, M. Hozawa and N. Imaishi 94
Moments of momenta as predictors of "molecular" species in crystal growth solutions
P.G. Barber 99

MELT GROWTH AND SOLIDIFICATION

Effect of nonequilibrium interface kinetics on cellular breakdown of planar interfaces during rapid solidification of Si–Sn
D.E. Hoglund, M.J. Aziz, S.R. Stiffler, M.O. Thompson, J.Y. Tsao and P.S. Peercy 107
Evolution of solidification microstructures at high interface growth rates
J.A. Sekhar 113
Some consequences of a strong interface field-effect operating during the growth of TiO_2–alloy crystals from the melt
W.A. Tiller and C.T. Yen 120

Oscillation phase relations in a Bridgman system
D.J. Knuteson, A.L. Fripp, G.A. Woodell, W.J. Debnam, Jr. and R. Narayanan 127
Liquid encapsulated crystal growth and electrical properties of Sb_2Se_3 and Bi_2S_3
R. Bacewicz and T.F. Ciszek 133
Growth of long quasicrystals in an Al–Cu–Co alloy
J.A. Lara V., H.G. Riveros, J. Reyes-Gasga and M.J. Yacamán 137

SILICON CRYSTAL GROWTH

Oxygen partitioning analysis during Czochralski silicon crystal growth via a dopant marker and a simple transfer function modeling technique. I. Rotation rate transients
C.T. Yen and W.A. Tiller 142
Turbulent heat transfer through the melt in silicon Czochralski growth
S. Kobayashi, S. Miyahara, T. Fujiwara, T. Kubo and H. Fujiwara 149
Charge carrier recombination centers in high-purity, dislocation-free, float-zoned silicon due to growth-induced microdefects
T.H. Wang, T.F. Ciszek and T. Schuyler 155
Float zone growth of high purity and high oxygen concentration silicon
A.G. Crouse, J.E. Huffman, C.S. Tindall and M.L.W. Thewalt 162
Melt motion in the float zone process with an axial magnetic field
K.H. Lie, J.S. Walker and D.N. Riahi 167
Segregation and impurity effects in silicon grown from the melt in the presence of second phase formation
J.P. Kalejs, B. Bathey and C. Dubé 174
Convection phenomenon during the dissolution of silicon in an indium solution
M. Kimura, A. Tanaka and T. Sukegawa 181
Growth of a GeSi thick alloy layer on a Si substrate by liquid phase epitaxy
T. Sukegawa, K. Yamashita, H. Katsuno, M. Kimura and A. Tanaka 186

III–V INGOT CRYSTAL GROWTH

Phase relations in GaAs crystal growth
H. Wenzl, A. Dahlem, A. Fattah, S. Petersen, K. Mika and D. Henkel 191
Influence of through-window radiation on the horizontal Bridgman process for rectangular shaped GaAs crystals
K.H. Lie, J.T. Hsu, Y.D. Guo and T.P. Chen 205
Growth of III–V ternary and quaternary mixed crystals by the rotationary Bridgman method
T. Ozawa, Y. Hayakawa and M. Kumagawa 212
Increased single crystal length in low-pressure, LEC gallium arsenide
H.D. Marshall 218
Silicon incorporation anomaly in LEC grown GaAs
A. Flat 224
Growth of (100) GaAs by vertical zone melting
R.L. Henry, P.E.R. Nordquist, R.J. Gorman and S.B. Qadri 228

III–V EPITAXIAL GROWTH

Growth rate, doping, and compositional uniformity in an atmospheric-pressure multiwafer OMVPE reactor
K.A. Bertness, J.J. Cubbage and J.G. Werthen 234
MOCVD of GaAs in a horizontal reactor: modeling and growth
L.R. Black, I.O. Clark, B.A. Fox and W.A. Jesser 241
MOCVD manifold switching effects on growth and characterization
I.O. Clark, A.L. Fripp and W.A. Jesser 246
Critical thickness in epitaxial GaAsP: comparison of theory and experiment
B.A. Fox and W.A. Jesser 252
Carbon doping and etching of MOCVD-grown GaAs, InP, and related ternaries using CCl_4
A.E. Kibbler, S.R. Kurtz and J.M. Olson 258

Effect of mesa shape on the planarity of InP regrowths performed by atmospheric pressure and low pressure selective metalorganic vapor phase epitaxy
J.L. Zilko, B.P. Segner, U.K. Chakrabarti, R.A. Logan, J. Lopata, D.L. Van Haren, J.A. Long and V.R. McCrary 264
Growth of InSb on GaAs by metalorganic chemical vapor deposition
R.M. Biefeld and G.A. Hebner 272
Effect of growth rate on properties of $Ga_{0.51}In_{0.49}P$ grown by organometallic vapor phase epitaxy
D.S. Cao, E.H. Reihlen, G.S. Chen, A.W. Kimball and G.B. Stringfellow 279
GaInP/AlGaInP strained quantum wells grown using atmospheric pressure organometallic vapor phase epitaxy
T.Y. Wang, A.W. Kimball, G.S. Chen, D. Birkedal and G.B. Stringfellow 285
Properties of GaInAs(P)/InP multilayers and superlattices grown by MOVPE at atmospheric pressure
J.P. André, J.N. Patillon, C. Schiller, J.Y. Lesiourd, O. Vlaeminck and N. Malhouroux 292

II–VI AND RELATED CRYSTALS

Low temperature deposition of single crystalline ZnSe films on GaAs substrates by slightly ionized molecular beams
K. Yokota, S. Tamura, T. Nakajima and S. Katayama 298
Purification, crystal growth and characterization of CdSe single crystals
A. Burger, D.O. Henderson, S.H. Morgan and E. Silberman 304
Vapor-phase growth of ZnO crystals by chemical transport and effect of metal doping
K. Matsumoto and K. Noda 309
Preparation and characterization of MgO thin films deposited by spray pyrolysis of Mg(2,4-pentanedionate)$_2$
W.J. DeSisto and R.L. Henry 314
Electronic, crystallographic and spin polarized properties of doped $CdSiAs_2$ single crystals
F.P. Baumgartner, M. Lux-Steiner, G. Doell, E. Bucher, F. Meier and A. Vaterlaus 318

LASER, ELECTRO-OPTICAL, AND DETECTOR CRYSTALS

Laser-heated pedestal growth of laser and IR-upconverting materials
B.M. Tissue, L. Lu, L. Ma, W. Jia, M.L. Norton and W.M. Yen 323
Valence and site occupation of chromium ions in single-crystal forsterite fibers
W. Jia, L. Lu, B.M. Tissue and W.M. Yen 329
Thermophysical properties of a $LiCaAlF_6$ melt
V.J. Fratello and C.D. Brandle 334
Top seeded solution growth of Cr^{3+} : $LiCaAlF_6$ in HF atmosphere
R.F. Belt and R. Uhrin 340
Nonlinear optics and phase conjugation in photorefractive materials
M. Cronin-Golomb 345
Approaches to understanding structure–property relationships in nonlinear optical materials
R.H. Jarman and M. Munowitz 353
Growth and characterization of doped KTP crystals
T.F. McGee, G.M. Blom and G. Kostecky 361
Reduction of the ionic conductivity of flux grown $KTiOPO_4$ crystals
P.A. Morris, A. Ferretti, J.D. Bierlein and G.M. Loiacono 367
Stoichiometry and electrical charge transport in HgI_2 crystals
H. Hermon, M. Roth, J. Nissenbaum, M. Schieber and J. Shamir 376
Growth and applications of Gd_2SiO_5 : Ce scintillators
T. Utsu and S. Akiyama 385
Directional solidification of HgCdTe and HgZnTe in a transverse magnetic field
C.H. Su, S.L. Lehoczky and F.R. Szofran 392

SUPERCONDUCTOR CRYSTAL GROWTH

Deposition of high temperature superconducting films by physical and chemical methods
M. Schieber 401

Single-crystal growth and low-field AC magnetic susceptometry of $YBa_2Cu_3O_{7-\delta}$, $ErBa_2Cu_3O_{7-\delta}$, and $Bi_2Sr_2Ca_{0.8}Cu_2O_8$ superconductors
T.F. Ciszek and C.D. Evans 418
Crystal growth and properties of $R_2Ba_2CuPtO_8$ (R = Ho, Er, Y), $R_2Ba_3Cu_2PtO_{10}$ and $Ba_4CuPt_2O_9$
Y. Saito, T. Shishido, N. Toyota, K. Ukei, T. Sasaki and T. Fukuda 426
A method for producing untwinned $YBa_2Cu_3O_{7-\delta}$ crystals without subjecting them to stress
J.P. Rice and D.M. Ginsberg 432
Preparation and magnetic measurements of single crystal $Tl_2Ba_2CaCu_2O_8$
J.Z. Liu, Y.X. Jia, P. Klavins, R.N. Shelton, J. Downey and D.J. Lam 436
Stoichiometry and irradiation effects in melt grown Tl–Ca–Ba–Cu–O single crystals
E.L. Venturini, C.P. Tigges, R.J. Baughman, B. Morosin, J.C. Barbour, M.A. Mitchell and D.S. Ginley 441
Mixed-perovskite substrates for high-T_c superconductors
D. Mateika, H. Kohler, H. Laudan and E. Völkel 447
Growth of single crystals of rare earth gallates
G.W. Berkstresser, A.J. Valentino and C.D. Brandle 457
Growth of single crystals of lanthanum aluminate
G.W. Berkstresser, A.J. Valentino and C.D. Brandle 467

Author index 472
Subject index 477